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A SYSTEM AND METHOD FOR OPTIMIZING ENVIRONMENTS TO FACILITATE AGENT PROCESSES

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a system and method for optimizing environments to facilitate agent processes conducted therein. The invention relates most particularly to a collaborative workspaces and collaborative workspaces developed using the system. More generally, the present invention relates to an iterative, feedback driven system for optimizing interaction among agents acting on multiple levels and use of the system for optimizing agent pattern language values in collaborative environments.

Terminology and References

Throughout the present application, certain terms of art are used. To assist in understanding the intended meaning of these terms in this application, reference should be made to certain published works as detailed hereinafter:

AGENT and **AGENCY** in the context of the present invention, agency is broadly defined to encompass individuals, machines, groups of individuals and/or machines, organizations of individuals and/or machines, and other things, such as documents, computer software, and firmware. In addition, agent as used herein is intended to have its broadest meaning humans, machines, groups or organizations. All systems are characterized by the interaction of the agents within the system. Depending on one's objectives, certain of these interactions become important to achieving the objective (typically some interactions are not important to the specific objective).

PATTERN LANGUAGE: as described by: "A Pattern Language" Christopher Alexander 1977 and demonstrated by; "The Wright Space" Pattern & Meaning in Frank Lloyd Wright's Houses" Grant Hildebrand 1991. (Both of the above references are described in "The Power of Place - How Our Surroundings Shape Our Thoughts, Emotions and Actions"-

Winfred Gallager, 1994 and in "Prospect Refuge"). "Frank Lloyd Wright - A primer in Architectural Principles" Robert McCarter, 1991.

DESIGNSHOP™ EVENT An event whose purpose is to release group genius in the client, condense the time in which a team moves from Scan to Act by an order of magnitude, completely capture and organize all of the information generated, and do all of this in a facilitated way by managing not the people involved.

MANAGEMENT CENTER™ Special environment for managing the design and innovation process in the context of expected social-economic change, and for building action plans to accomplish the goals established. By careful facilitation of the elements of environment, information, design and group process, Management Centers decrease the "accident" factor of discovery and synergistic events. Management Centers are "safe" environments in which designers and decision-makers can risk exploring and creating new models. Also called "DesignCenters".

RADIANT ROOM A large space in a Management Center where the participants gather together as one body to hear reports or have synthesis discussions of some sort. The focus of the Radiant Room is a long WorkWall called the Radiant Wall that may be straight, folding or curving depending on the design of the individual center. Some Radiant Walls stretch to over 40 feet in length. The backside of the Radiant Wall is frequently covered with an adhesive material made by 3M to which paper can be adhered and removed many times over. This is called the Knowledge Wall, although you may hear it called the Sticky Wall by old timers in the network.

WORKWALLS™ Panels of light colored porcelain steel which accept a variety of marking materials such as chalks, dry erase markers, water colors, India ink, pastels, and water based markers. They are used by participants and KreW as a tool to support collaboration. A typical Management Center may have more than 3,000 square feet of this surface available. Large or small groups can illustrate complex issues and detailed plans all within plain view of

the entire group, and all easily editable. The amount of information that can be manipulated on these wall systems and the flexibility of erasing or adding to it, dwarfs the capabilities of butcher paper, flip charts, or projection systems. The walls are typically six or more feet high and may be any length. Rolling walls come in lengths from four to sixteen feet in length, some of which are folding. WorkWalls may also be permanently installed within the Environment. The walls are manufactured by Athenaeum International for MG Taylor and distributed by Athenaeum International or through MG Taylor Corporation's chain of KnOwhere stores.

KNOWLEDGE WALL Management Centers have at least one large wall—sometimes up to 50 feet in length, usually the back side of the Radiant Wall—that is covered with a mildly adhesive surface manufactured by 3M. This wall serves as an oversized European-style kiosk. All sorts of information may be posted to the wall. Sometimes portions of the documentation are placed on it. Photographs, color art work, and diagrams are also posted here. Articles from magazines or the Internet are also displayed for participants to browse through. Information is not displayed haphazardly, rather, a layout is thoughtfully designed, making the wall a structured information event.

ARMATURE: as described by: "Building to Last" - Architecture as Ongoing Art" Herb Green, 1981.

RULES OF ENGAGEMENT A list of boundaries that must be set on a DesignShop, session, Management Center or NavCenter in order to secure success. The requirement of having no observers or visitors during a DesignShop is an example (everyone either participates or they are on KreW). Another example is the limitation on the conduct of other business by the participants during the DesignShop (it destroys breakout team integrity and compromises the product to have individuals constantly conducting other business away from the team on the phone).

SYNERGY means behavior of integral, aggregate, whole systems unpredicted by behaviors of any of their components or subassemblies of their components taken separately from the whole. In addition, there is a corollary of synergy known as the Principle of the Whole System, which states that the known behaviors of the whole plus the known behaviors of some of the parts may make possible discovery of the presence of other parts and their behaviors, kinetics, structures, and relative dimensionalities.

Background

The traditional collaborative work space, or office space arrangement used today is a remnant of the 19th Century. It is widely recognized that there are of variety of deficiencies with traditional collaborative work space systems. In part, these problems result from the variety of needs and/or objectives that a collaborative work space must satisfy today. For example, it is desirable to provide knowledge workers with as much work space and as great a variety of work space as possible. On the other hand, there is a desire, for economic reasons, to maximize density (the number of knowledge workers per square foot of office space). As office space has become more important the desire for density and efficiency has become paramount. It is also recognized that plug and play or modularity of office furniture systems can enhance efficiency. Likewise mobility and user mobility are desirable objectives. These objectives can broadly be termed as addressing human values, that is values related to pragmatic and economic concerns. As used herein the expression "human values" is intended to encompass the range of economic and pragmatic values that are affected by work space design.

From the vantage point of the User, human values include (but are not necessarily limited to): ABILITY TO CONTROL - light, temp, sound, view, "sense" of isolation or involvement; ADAPTABILITY - minute, hour, day, week month year scales; CONFIGURATION; ADJUSTIBILITY TO WORK & USER STYLE; SPACE FOR MULTIPLE TASKS - "open" @ once different tools; INDIVIDUAL & TEAM WORK; PROSPECT; REFUGE.

From a manager's vantage point, human values include (but are not necessarily limited to):; USE OF SPACE PER INDIVIDUAL often assumed to require a compromise between economic pressures (less space) and knowledge work requirements (more space).;

WIRE MANAGEMENT - ; MANY WIRES -Changing all the time; AVOID PLACEMENT OF WIRES IN BUILT WALLS; BUILD INTO WORK WALLS, FURNITURE, ARMATURE ELEMENTS.; PLUG & PLAY - Code Differences.

A particularly important concern is ADJUSTABILITY: which involves a variety of objectives, including (but not limited to); MINIMIZING "PRIEST HOOD"; ONLY USER CONFIGURABLE "OFFICE SCALE" FURNITURE SYSTEMS; TRUE ADJUSTABILITY IS NOT "EVERYONE THE SAME SO ANYONE CAN GO ANYWHERE"; SCALES OF ADJUSTABILITY - Time, Physical, color, texture, movement within personal space within team setups, Building to building.

Another important concern that is frequently not addressed by standard open space systems is the desire for PLACE OWNERSHIP. To address this concern, one must provide the ability to Customize Individual Spaces to allow work process access and a public/private feel and to Customize Team Spaces. In short, users should be able to "own", customize, keep and evolve their components, including the ability to take components with them (easily) when they move.

COMPLEXITY: Existing Systems inherently lack sufficient complexity to make arrangements that: Achieve density; Achieve individual user require space (and <u>kinds</u> of spaces); Allow full use of foot print (no wasted, single-use spaces); and address: Pattern Languages (Demonstrated values); Armature (Alexander, Ching, Greene, Flun and Brand); Prospect & Refuge (Gallager, Day); Order & Complexity; and Evolution & Adaptation

DURABILITY- Modern systems best when new, the materials not repairable, the styles (limited by the system) do not have not intrinsic design - they get old, dated. The present invention is intended to mellow (age gracefully), last for years and be easily fixed & adapted. For example, a standard straight work wall panel can: hang on wall; fold on track or wheels; slide or double hang. Similarly, an individual pod can be one-piece work station, two, three, etc., to complete room (or "s" curve).

Within this universe of concerns, it is widely believed that there are inherent conflicts. For example, the need for greater density, for more knowledge worker space and a greater variety of knowledge worker work space typically believed to directly conflict with the need for greater density. Likewise, the need for greater variety of work space has been viewed as conflicting with the need for greater modularity.

Recently efforts have been focused on the human values concerns. In particular, it has been recognized in the prior art (see US Patent No. 5,684,469 assigned to Steelcase Inc.) that as modern offices become increasingly complicated and sophisticated the needs of the users for improved utilities support and collaborative work space are increasing. One important consequence of the advent of sophisticated electronic offices is the increased need and desirability for distributing utilities throughout the various offices in a manner which can be readily controlled. The efficient use of building floor space is also of great concern, particularly as building costs continue to escalate. The inherent nature of modular furniture systems, which permits them to be readily reconfigured into different arrangements, makes it very difficult to achieve adequate utility distribution and control.

So-called "open office plans" typically comprise large, open floor spaces in buildings that are furnished in a manner that is reconfigurable to accommodate the needs of a specific user. Many such open plans includes movable partition panels that are detachably interconnected to partition off the open spaces into individual workstations and/or offices. Such partition panels are configured to receive hang-on furniture units, such as worksurfaces, overhead cabinets, shelves and the like. An alternative arrangement for dividing and/or partitioning open plans includes modular furniture arrangements, in which differently shaped, freestanding furniture units are interconnected in a side-by-side relationship, with upstanding privacy screens attached to at least some of the furniture units to create individual, distinct workstations and/or offices. As recognized in US Patent No. 5,651, 219, these types of conventional workstation arrangements do not optimize human (i.e., economic and pragmatic) design values. For example, conventional designs of these types are not particularly adapted to support workers engaged in group work, such as self-managing teams, or others involved in team problem solving techniques, wherein a relatively large number of workers from different disciplines, such as engineering, design, manufacturing, sales, marketing, purchasing, finance, etc., meet together as a group to define and review issues, and set general policy, and then break out into either smaller sub-groups, or into individual assignments or projects to resolve those specific problems relating to their particular discipline. Group work is steadily gaining importance as a way of improving productivity and time-to-market, thereby emphasizing the need to support such activities more efficiently and effectively.

In addition, built-in offices and conference rooms are typically expensive to construct and maintain, and are not usually considered an efficient use of space in open plan environments. When such conventional rooms are constructed in rented office space, they become permanent leasehold improvements, which must be depreciated over a lengthy time period, and can not be readily moved upon the expiration of the lease. The reconfiguration of such spaces is quite messy, and very disruptive to conducting day-to-day business. Furthermore, with conventional conference room arrangements, breakout meetings among the various sub-groups of workers often prove inconvenient, since the offices of the participant workers are seldom located in close proximity to the conference room.

It is recognized that group problem-solving techniques necessarily involve some degree of interaction between coworkers, thereby creating the need in furnishings for modern office environments to promote the establishment of an optimum balance between worker privacy and worker interaction.

There have been various attempts to address these pragmatic and economic human concerns. For example US Patent No. 5,684,469 assigned to Steelcase Inc. proposes a utility distribution system for modular furniture of the type comprising individual furniture units that are juxtaposed to form one or more workstations.

US Patent No. 5,675,949 assigned to Steelcase Inc. discloses a utility distribution system is open office plans and other similar settings, that includes a prefabricated floor construction designed to be supported directly on a building floor.

US Patent No. 5,651,219 assigned to Steelcase Inc. describes a workspace module for open plan spaces, and the like, that includes a compact footprint, comprising a freestanding framework supporting a three-sided partition to form an interior workspace and a portal opening for user ingress and egress.

US Patent No. 5,651,219 seeks to provide a compact and dynamic workspace module that is particularly adapted to effectively and efficiently support knowledge workers engaged in group work activities in open plans, and the like.

US Patent No. 5,511,348 assigned to Steelcase Inc. discloses a furniture system particularly adapted to support group activities in open plans. The system includes a plurality of columns supporting an overhead framework on the floor of a building in a freestanding fashion at a predetermined elevation, generally above average user height. A

plurality of individual panels are provided, wherein each panel is constructed to permit easy, manual, bodily translation of the same by an adult user. A hanger arrangement is associated with the overhead framework, and cooperates with connectors on the panels to detachably suspend the panels at various locations along the overhead framework. The panels are manually reconfigurable between many different arrangements to efficiently and effectively support different group activities.

While the designs described in these recent patents address some of the human value concerns by providing more efficient systems, they fail to appreciate, much less address, the need to address architectural pattern language values. As a result, the components described are not sufficient to optimize both human and pattern language values. In addition, the emphasis on pragmatic and economic values has led to an emphasis on standardized systems that attempt to achieve maximum efficiency without consideration of other important values such as, high variety, the use of natural materials to achieve true durability, true reconfigurability, architectural armature, prospect and refuge and perhaps most importantly, pattern language values.

Given the emphasis on efficiency and pragmatic and economic concerns, it is not surprising that well known systems that address one or more the previously mentioned objectives do so by sacrificing other objectives.

In particular, conventional furniture systems do not allow optimization of human and pattern language values. With regard to Human Values, the variety of furniture and work space arrangements and configurations does not match the variety needed to solve the problems, i.e., to meet and optimize and (all the pragmatic, human and economic) values. In this way, furniture design limits the range of possible solutions sets and limits the ability to create environments that facilitate collaborative interaction. Moreover, while pattern language values are well documented (see Alexander), most cannot be achieved using conventional "off the shelf" furniture components. Custom design is required. This is very expensive and non-standard and requires a case by case approach.

In addition, there is a continuing need to integrate, preferably in a seamless way, new technologies into the collaborative workspace. Before the advent of the Internet, distributing information to all the interested decision makers was prohibitively expensive. Today, the world wide web is an unparalleled distribution channel, where the cost to provide

information to an extra user is essentially zero. This makes massive distribution of corporate data economically feasible for the first time in history, turning every Internet user into a potential customer for data.

Thus, there remains a need for a comprehensive system and method that provides an optimal solution by addressing each of these of these objectives without sacrificing other objectives.

SUMMARY OF THE INVENTION

The present invention broadly relates to a systematic approach to the optimization of environments to facilitate the agent interactions occurring within the environments. The invention is, for example, useful in optimizing collaborative environments, but the invention is not limited to such environments. The invention also provides novel environments, including collaborative environments, that result from this systematic approach. The present invention is grounded in the inventor's recognition that collaborative environments are complex systems that both include complex agent systems and operate as agents within even larger scale complex systems. As explained below, the present invention results from the synergistic combination of recent technologies, insights into agent interaction and insight into the relationship between environment, processes and tools.

The system and method of the present invention as it pertains to collaborative environments provides a way-of-working that unifies the value of AGENTS of all kinds: Human, machine, environmental and a wide array of tools, infrastructure elements and methods of information storage and commerce.

The scope of this invention relates to the facilitation and augmentation of physical, mental and virtual Agents on multiple levels of recursion. It is a basis of this invention that all things (and "no"-things) can be seen and treated in the language of Object-Oriented "code" that establishes a family of relationships and rules that govern the interactions of the Agents. Further, that complex, emergent "life-like" systems involve the interaction of multiple Agents through multiple iterations and on multiple levels of recursion; that complex behavior emerges as the consequence of iteration, recursion, feedback, critical mass and the specific "genetic code" (rules, algorithms) that govern the interactions.

Complex behavior of complex systems is not predictable nor controllable in the common sense of these words. This gives rise to many problems in the realm of Human actions in complex creative relationships and economies. Prior to the present invention there has been no method and system for describing, creating and acting upon Agents in such a way that desired results can be accomplished in a reliable manner without destroying the phenomena of "group genius" and emergence thus degrading the result to a simple-solution that lacks adequate requisite variety with the situation in focus. In other words, the limits of the methods available, themselves, set the scope of the "solution-sets" available that are increasingly becoming categorically and systematically non-viable.

As Humans struggle with the emerging complexity, time compression, the global nature and virtuality of the so called "Knowledge Economy," these limits of applying essentially linear, sequential, "simple" methods to ever more complex situations becomes creates conditions that are increasingly unstable and dangerous.

There are myriad conditions that have to be understood, organized and acted upon to succeed in the realms covered by this invention; however, prior to this invention, there exists no unifying language, system and method of work to do so. In the realms of Human work processes, environments and tooling which facilitate creativity, as one example, many different languages are employed to "describe" phenomena and direct action. This "Tower of Babel" exists among the fields related to these realms - on the level of recursion related to humans - and, almost totally fails to describe, recognize and provide necessary structure "below" (neural nets, computer codes, tool kits) and "above" (environments, systems, organizations, networks, ecologies) thus making unified, systemic action impossible. This web of phenomena is seen and treated as different, unrelated and often contradictory (the perceived conflict between human economies and natural ecology, as example). This drives immense confusion, poor utilization of resources and an emergent behavior of increasing instability in complex systems such as human collaboration, large organizations, global networks and economies.

It is a significant insight of the present invention that a system and method is required to "see" and treat (act upon) collaborative workplaces within a broad bandwidth in an unified way that:

1) Provides a language (Descriptive, Technical, Pattern Language, Modeling Language, Algorithm, Deep Language) that describes the necessary phenomena, from the levels of neural nets to global economies, as essentially similar and reoccurring, rule based processes that can be treated in consistent, concurrent engineering terms (in other words, the similarities between the complex phenomena can be described);

2) Provides the ability to create environments (made up of processes, environments and tools - which can be also treated as Agents - so that Agents (on the levels of recursion from computer code to networks) can be augmented, facilitated and "acted upon" in such a way as to systematically promote interaction, collaboration, synergy, leading to desired emergent behavior;

3) Provides the processes and rules of interaction so that the proper facilitation of interaction among Agents (of many *kinds*) is accomplished; so that collaborative environments for these Agents are created in this context;

4) Provides the net result of Human collaboration and "group genius" (with orders of magnitude greater productivity and reduction of time and effort - therefor cost) able to remain requisite with the complexity that humans themselves are creating while being able to better integrate human actions with other natural phenomena.

One enabling component of the present invention is an understanding of agent (e.g., human) processes or interactions that one wishes to facilitate. The present inventors have, for example, developed and published various detailed models of the creative process and collaboration that allow the system and method of the present invention to be used to foster group genius.

In general, the system and process of the present invention address environment, process and tools in a way that creates an improved environment for group interaction. At the highest level, these areas are each addressed through description, explanation and specific physical examples. At a deeper level, the elements are addressed through high-level manuals written in a language that can be understood by the agents. At a still deeper level, the

essential concepts involved can be described in models and/or glyphs. The glyphs are original artistic expressions of concepts relating to group dynamics. Collectively, the glyphs, when used in connection with a grammar system, constitute a separate language somewhat analogous to a fourth-generation language. At a still deeper level, the present invention makes use of a series of rules or algorithms that effect an environment, process and tools.

The inventors have developed a modeling language and grammar system to describe some of the concepts underlying the system and method of the present invention. This language and grammar are reflective of elements of tools and other aspects of the invention and are thus critical to a full understanding of the method and system. To this end, the following brief definitions are set forth:

Ten Step Knowledge Management: The engine for processing information from events through a knowledge base, into distribution, into design, and on to subsequent events.

Scan-Focus-Act: A basic representation of the creative process in three stages (plus a feedback element). Each of these stages are not "step" I the linear and sequential sense, but are "modes of operation" from which the material in hand is viewed and acted upon.

Business of Enterprise: The network-based architecture for linking the functions of production, investment, consumption and management in the Knowledge-based enterprise.

Stages of an Enterprise: The Lifecycle of the enterprise including special situations such as overshoot and collapse, turnaround, the entrepreneurial button.

5 E's of Education: The necessary and sufficient components of a complete educational package.

Vantage Points: Seven shells of context from philosophy to task that must be in place for enterprises to maintain homeostasis.

Seven Domains: The seven areas that are managed in every enterprise and every activity of the enterprise. When managed properly they ensure corporate health and allow Knowledge-based organizations to grow and profit.

Seven Stages of the Creative Process: The most complex of the creativity models developed by the present inventors, this model explains how problems are created and then solved in a process that is recursive, fractal, cyclic and nonlinear in character.

'Spoze: The 'Spoze model holds the secret for allowing systems to evolve in rapidly changing environments and yet maintain their own homeostasis and identity. Enterprises use 'Spoze to innovate without having to grab on to every new idea that passes by.

Appropriate Response: Every stage of the Creative Process involves producing a result. Superior results can be obtained by filtering or testing competing designs through the six elements of this model.

Three Cat: We all build mental concepts of how things work by observing reality. But to cement the learning, we must build models that exemplify our concept and test these models against what we observe to confirm our understanding.

Design Build Use: The unfolding of a project or creation over time is an interactive, iterative game between the designer, builder and user. However, when we make the process linear, discrete and focused on being "finished", the outcome is a nonliving one.

Creating the Problem: This model explores the relationship between vision and condition that creates the "problem." It continues with a description of the tug and pull of creative tension that brings the vision and conditions together to create a new condition.

The Learning Path: Five Points of Mastery: Instead of the three traditional roles of education (student, teacher, administrator), we present five: the learner, the sponsor, the expert, the facilitator, and the steward. In high performance environments each individual moves from role to role sometimes in rapid succession and sometimes in cycles that span years.

The Four Step Recreative Process: The creative process has many facets and can be understood and practiced from many different vantage points. The Four Step model emphasizes the activity of recreation between each stage of the creative process and shows this recreation as a wave and a particle phenomenon—linear and non-linear approaches.

Each of these essential concepts can be described in models and/or glyphs. The glyphs are original artistic expressions of concepts relating to group dynamics. Collectively, the glyphs, when used in connection with a grammar system, constitute a separate language somewhat analogous to a fourth-generation language.

To achieve the stated and other objects of the present invention, as embodied and described below, the invention includes a method for fostering creativity comprising the steps of identifying a number of agents and selecting a subset of these agents based on certain

determined criteria and other methods. An environment for creative interaction is prepared, and the agents selected are placed within this environment. Work is then performed on these agents in order to develop a result. The result is then evaluated, which produces a first new agent. This first new agent produced is then tested.

Further, the first new agent may be added as an agent to the existing environment, added as an element of the environment, or added as additional work to be performed in the environment by the agents, and the process of the present invention is then repeated with this new element to produce a second new agent.

In addition, the first new agent may be added to an external environment, wherein the first new agent is altered and may return or produce a third new agent for return, in which case, the altered first new agent or the third new agent is added as an agent to the existing environment, added as an element of the environment, or added as additional work to be performed in the environment by the agents, and the process of the present invention is then repeated with this new element to produce another new agent.

The method is consistently repeated until a pattern appears. This pattern can be readily identified and discussed using the specific language developed by the present inventors.

In a broad sense the present invention is the result of the synergistic combination of emerging technologies, with emerging insights as to human processes and emerging insights as to the relationship of between the two, i.e. how things that are perceived at different level of consciousness affect human processes. Thus, technologies that enable rapid reconfiguration of environments are an important component of the present invention. This applies not only to reconfigurable furniture (which the inventors have developed) but also, lighting, sound and other sensory experiences that we now know affect human processes. As the ability to control the sensory inputs to agents within an environment increase, the usefulness of the present invention increases.

The ability to control sensory inputs to agents operating within an environment is thus an important enabling technology for the present invention. Thus, for example, the active control of lighting within an environment, which is by itself well known, is incorporated into the system of the present invention to achieve a synergistic improvement in human processes.

There has been recent innovations in acoustic technologies that the present inventors have found can be used to achieve similar control of sound within an environment. In particular, much of the past 40-plus years of loudspeaker development has revolved around identifying, understanding and then suppressing diaphragm resonance and their resulting coloration and 'smear'. Now a new drive unit technology that, rather than attempting to eliminate diaphragm resonance, encourages and exploits it has been introduced. This new speaker technology, introduced by New Transducers Ltd. Of England, is referred to as distributed mode speaker technology.

Distributed mode speaker technology involves treating a diaphragm vibrating randomly across its surface rather than coherently. Each small area of the panel vibrates, in effect, independently of its neighbors, rather than in the fixed, coordinated fashion of a pistonic diaphragm. Such a randomly vibrating diaphragm behaves quite differently because power is delivered to the mechanical resistance of the panel, which is constant with frequency. The radiation resistance is now insignificant because the air close to the panel also moves in a random fashion, reducing the effective air load. This means that diaphragm dimensions no longer control directivity: you can make the radiating area as large as you want without high frequency output becoming confined to a narrow solid angle about the forward axis. Such diaphragm behavior clearly opens up the possibility of a full-range driver freed from the familiar restraints and compromises. The distributed mode speaker does not actually make the diaphragm vibrate randomly, but instead simulates this by using distributed-mode operation. Essentially this involves encouraging the diaphragm to produce the maximum number of bending resonances, evenly distributed in frequency. The resulting vibration is so complex that it approximates random motion.

There are also numerous spin-off benefits. As well as being insensitive to diaphragm size, the acoustic behavior (other than sensitivity) is unaffected by diaphragm mass. The technology is truly scaleable: you can make the panel large without directivity or treble response suffering. In fact it actually improves in performance as it is increased in size because the frequency of the fundamental bending resonance is lowered, which not only extends the bass response, but also increases modal density in the mid and high frequencies.

The diaphragm of a distributed-mode loudspeaker vibrates in a complex pattern over its entire surface. Close to the diaphragm the sound field created by this complex pattern of

vibration is complex also, but a short distance away it takes on the far-field characteristics of the distributed-mode loudspeaker radiation. This is close to the directivity of a true point source - i.e. approaching omnidirectionality - even when the diaphragm is quiet large relative to the radiated wavelength.

Distributed mode is a highly deterministic technology: the acoustic performance of an distributed mode panel can be very accurately predicted once a few key parameters are specified relating to the size and shape of the panel, the positioning and electromechanical properties of the exciter(s), and the material properties of the panel material itself.

To aid the design process, a commercially available software suite is available that offers three layers of sophistication according to user requirements. At the simplest level you can input target specifications and the software will design a solution for you. Or you can delve deeper into the design process by specifying different panel material properties and performing sophisticated 'what if' analyses in which different aspects of the design are altered and the outcomes assessed.

Currently known uses of distributed mode speakers include ceiling tile loudspeakers, banner loud speakers and slide out ultra thin lap top computer speakers. It is clear, however, that the significance of distributed mode speaker technology to the design of environments is not fully understood or appreciated. Indeed, as explained below, the present invention provides are significant new uses of distributed mode speakers that have not previously been contemplated.

One embodiment of distributed mode speaker system looks like little buttons, a plurality of which are located on a plane, for example, a panel such as a thin foam core board. In operation, the entire plane vibrates and creates an incredible acoustic effect. The acoustic effect is particularly interesting because it tends to be unidirectional, in other words, it tends to come from that surface forward so that you hear *it* but it doesn't fill up the space. Thus, the sound coming from the speaker is heard if one is in front of the plane of the speaker you hear it, but not heard very well if one is adjacent or around from the plane of the speaker. Another feature of distributed mode speakers is that the electronics by which this is done is such that the feedback that one normally get when recording and playing back in the same room is eliminated

In accordance with another aspect of the present invention, distributed mode speakers can be thoroughly integrated into a collaborative environment. For example, the distributed mode speakers can be built into the furniture, knowledge objects, signs, walls and ceiling tiles or even into the floor (recognizing, of course, that different materials have more of an acoustic range).

In addition, from the vantage point of the design of environments, there is another significant feature of the distributed mode speaker design: they are inexpensive and thus can be ubiquitous within the environment. It follows that the distributed mode technology can be combined with other acoustic technologies that are known to affect environments including sound, music; white noise; sound cancellation. The emergence of technologies, such as the distributed mode speaker, that make it possible to control these acoustic effects make it possible, within the context of the present invention, to systematically control sound within an environment to, for example to facilitate an objective such as facilitating collaboration.

Thus, in accordance with the present invention, it is possible to create an "acoustic space" within any environment by, for example, building an array of speakers throughout the environment and controlling the speakers (through a mixer or the like) to broadcast music, white noise or cancellation in various combinations to create an acoustic space. This makes it possible to control the sound within the acoustic space in a systematic way to achieve a desired objective. For example it is possible to define and control the sound within several acoustic spaces defined within a collaborative environment so as to facilitate the activity occurring within each space. It is possible, for example to amplify someone's voice and play it back so softly that in effect you really wouldn't know that you have amplified that voice, it is possible to control the amount of reverberation that the room has, it is possible to take space that doesn't have any of those characteristics and you create that reverb, it is possible to select certain frequencies that you want to cancel out while you are doing this at the same time. It is possible to create dead acoustic spaces. More importantly, it is possible to create live acoustics that have certain characteristics and if people are in a live acoustic space, they'll stop shouting over things. Because occupants will adjust how they are talking to the acoustics of their place. In short, it is possible to create actively controlled acoustic spaces within the environment – the number of discrete spaces and the precision by which they are controlled is principally dependent upon the size of the environment and the investment in

hardware components. One can create a different kind of acoustic space, not only as a fixed space but variable. A computer and other equipment can be used to monitor the acoustic space and allow active control by a computer programmed to establish different kinds of spaces and do space characteristics and shape the acoustic space as you want.

Precise control of sound is useful in the design of other environments as well. For example, in the transportation environment, sound can be controlled to achieve an objective such as passenger comfort in accordance with the present invention.

Of course, there are existing technologies for actively controlling lighting and emerging technologies for control of smell and taste. All of these technologies are preferably employed to the extent practical.

In this way the environment is controlled in relationship to the creative process. This is possible to the extent that those things that stimulate the senses (and thus affect the environment) such as sound, light, smell can be actively controlled in relationship to the process.

Thus, the present invention provides an environment in which the configuration of furniture, lighting, and sound can all be actively controlled in relationship to the process being conducted within the environment. To use this environment to facilitate collaboration of agents within an environment, for example, one must have a model of the process being conducted within the environment. In the case of problem solving, for example, the present inventors have, as noted above, developed models of the creative process and collaboration that allows one to understand how an environment should be controlled at various stages of agent interaction.

The environment can be tailored to a process occurring within the environment provided the process is mapped. The present inventor have, as discussed above, developed a map of the creative process referred to as a "solution box". The solution box is a 7x7x7 three dimensional grid mapping Design against Formation against Vantage Point that define where a group is within the creative process. Based on one's location within the solution box a specific kind of environment that will facilitate the process is defined. The system of the present invention makes it possible, therefore, to facilitate a process in real time by modeling the process as a multi-step process, defining environmental characteristics that facilitate various steps in the process determining in real time where one or more agents are within the

process, and controlling the configuration, lighting, sound or other sensory aspects of the environment based on the agents location within the process.

The present invention thus provides an environment that is reconfigurable to facilitate the interaction of agents (humans, machines, groups, organizations and combinations thereof), within the environment in accordance with a predetermined model of the interaction of the agents that prescribes appropriate environment conditions based on the status of agent interaction within the system of the interaction of the agents. The environment includes means (such as sensors or human observers) for determining the location of physical components within the environment, means (such as humans or machines moving reconfigurable components) for reconfiguring physical components within the environment, means (such as sensors or human observers) for determining the lighting characteristics in a plurality of discrete regions within the environment, means (such as humans and/or computers moving reconfigurable components or operating adjustable components) for adjusting lighting within the environment, means (such as sensors or human observers) for monitoring sound within the environment, means (such as humans and/or computers moving reconfigurable components or operating adjustable components such as distributed mode panel speakers) for adjusting sound within the environment, means (such as sensors or human observers) for monitoring and determining the status of agent interaction within the environment; and means (humans or computers controlling components) for reconfiguring physical components and adjusting lighting and sound within the environment in response to the determination of the status of agent interaction within the environment.

The environment can include a variety of reconfigurable components including, without limitation, rolling work walls, workpods on rolling casters, rolling kiosk components, stackable shelf cubes, rolling wing work surface components.

The insight of the present invention is that "structure wins" and that the factors limiting the present economy are intrinsic, structural and technical. It is not simply a matter of Human imagination, level of effort or good will. To appropriately effect a complex system one must act upon the system *as a system*. To do this the Law of Requisite Variety (Asby, Beer) must be met. Existing processes, tools and environments do not allow this.

Many aspects of the present system-in-place are contrary to the precepts and necessary conditions for the emergence of a true Knowledge Economy. This is a "technical" problem

and the languages, methods and tools of the present economy, as expressed in business, economics, politics and social theory cannot address the necessary levels of "action" that are required. The technical system of communication, banking and legal structures further impede growth and transition. The Industrial Economy cannot evolve into a Knowledge Economy - there are too many systems-in-place that cannot be removed without causing premature failure on the existing order. This would have disastrous results. However, the emerging elements of the new economy are driving unprecedented growth and complexity that can "blow up " the present system's ability to respond. Many "solutions" actually increase complexity further thus increasing the rate of decline of the system that was "fixed." This is the result of too many, misplaced positive feedback loops built into many key elements of the system.

A new system has to be put in place that can exist in parallel with the old while augmenting the Industrial Economy and replacing it over time. This process has to allow "Graceful Failure". The present invention, therefore, composes a whole system that can emerge, incrementally, augment the existing order but, ultimately, create a system with orders of magnitude more flexibility and capability of processing complexity.

In a broad sense, the interaction and integration of components and other "agents" within the collaborative environment and the recursive and iterative aspects of the system of the present invention relate to the issue of intelligent environments. An example of this is that an Agent on the level of an JAVA Applet is seen to be no different than a human Agent in a DesignShop or a KnOwhere Store (as an) Agent in a NetWork. All of these agents act by rules and can be facilitated. The present inventors have found that it is the similarities among these agents that are critically important. All these exhibit many of the same behaviors and a mind/brain neural Agent as described by Minsky. In contrast, differences are species specific and thus less relevant to the overall system and process of the present invention.

The vantage point of similarities among vastly "different" agents then offers a new perspective for designing collaborative environments. This insight, in addition to iteration and recursion critical mass and entrainment, are the foundations here for truly intelligent systems.

In particular, the system of the present invention includes a plurality of real agents each real agent having a plurality of characteristics. Agents are used in the sense previously defined.

The system further includes means for creating virtual agents to represent real agents in the system, each of the agents containing data corresponding to some characteristic of the real agent represented. This means can be a computer capable of copying computer code to replicate another agent or biochemical replicators or humans creating copies of agents. Humans, teams, groups and organizations can create models.

The system further includes means for allowing at least some of the agents to control the degree to which data corresponding to characteristics is revealed to other agents. Humans and agents at higher levels of recursion (teams, groups organizations etc.) plainly have this capability and computers can be programmed to create software agents (e.g., objects or applets) that reveal more or less data to other agents. This feature can also be achieve through known biochemical techniques.

The system further includes means for allowing agents to control other agents, including themselves. Humans and other agents operating at higher levels of recursion typically can control themselves and agents at lower levels of recursion, including tools. Human agents and agents operating at higher levels of recursion can, but do not necessarily have control, over agents at their own level of recursion. Computers can be used to create software agents (e.g., objects or applets) that control other software objects.

The system further includes means for at least some of the virtual agents having an access/use characteristic that allows access or use only to agents having access privilege corresponding to the agent. Computers can be used to create software agents (e.g., objects or applets) that have an access/use characteristic. There are also known biochemical techniques for controlling access. At the human level and higher levels of recursion, there are numerous was of controlling access, including, without limitation, password protection, locks and biometrics tools.

The system further includes means for allowing the agents to posses access or use privileges with respect to access or use of other agents. Computers can assign or grant privileges to software agents (e.g., objects or applets). There are also known biochemical techniques for granting access to certain agents, but not others. At the human level and

higher levels of recursion, there are numerous ways of gaining access, including, without limitation, key passwords, locks and biometrics characteristics.

The system also includes means for allowing agents to control what is revealed by those agents that they control. Computers can limit the degree to which software agents (e.g., objects or applets) communicate with one another. There are also known biochemical techniques for determining certain characteristics of other agents, but not others. At the human level and higher levels of recursion, there are numerous ways of limiting disclosure.

The system also includes means for allowing agents to modify the agents that they control. This means can be a computer capable of altering computer code to modify another agent or biochemical replicators or humans creating copies of agents. Humans, teams, groups and organizations can modify models and lower level agents and some agents at or above their own level of recursion.

The system also includes means for allowing agents to replicate other agents to the extent the characteristics of the other agents are revealed. Again, this means can be a computer capable of copying computer code to replicate another agent or biochemical replicators or humans creating copies of agents. Humans, teams, groups and organizations can create models and other agents through copying what they observe.

The system also includes means for measuring actual performance of agents. Any known measurement means can be used. The measurement may be objective, e.g., a quantity or measured value or the measurement may be subjective, e.g., "good" or "bad."

The system also includes means for inputting expected performance of agents. The means for inputting may be a human to computer data interface, communication between software objects, biochemical communication, a statement of goals and objectives.

The system also includes means for comparing actual performance of agents to expected performance of agents The comparison may be objective, e.g., a difference between a desired and actual quantity or measured value or the comparison may be subjective, e.g., "goals met" or "objectives achieved."

The system also includes means for modifying agents based on the difference between actual performance of agents and expected performance of agents. Again, this means can be a computer capable of copying computer code to modify another agent or biochemical agents or humans altering of agents. Humans, teams, groups and organizations can modify models

and other agents through altering the composition of the agent components, e.g., the members of a steam or the objects used in an "electronic" environment.

The system also includes means for allowing communication between agents limited to what the agents reveal about themselves. There are myriad forms of agent communication from direct human to human communication to biochemical reaction to electronic communication to communication through networked computers. Any known means of communication may be used.

The system also includes means for determining the location of agents within the system. Again, any known means may be used. Computers can track and keep records of the location of objects in the system or software objects can be programmed to report their own location. With human agents and tools, GPS is an effective way of communicating an agents location to an electronic agent. Any of the senses smell, sound, visual touch can be used to determine location, however.

The system also includes means for determining the health, status or condition of agents within the system. Any known means may be used for this purpose. At lower levels of recursion direct measurement is possible with tools or systems. At higher levels of recursion health, status or condition can be sensed or monitored electronically or determined through inspection by other agents.

The system also includes means for determining the value that other agents places on access, control, use or communication of another agent and report. The means employed can be any form of market (live or virtual), an auction, an electronic or textual reference table, e.g., "the Blue Book" or a table of Pattern Language values, a physical characteristic, e.g., "attraction" or actuarial tables and statistical analyses.

The present invention also contemplates a variety of methods for optimizing interaction among agents that include various combinations of the following steps: creating virtual agents to represent real agents in the system, each of the agents containing data corresponding to some physical characteristic of the real agent represented; at least some of the agents can control the degree to which data corresponding to physical characteristics is revealed to other agents ; allowing agents to control other agents, including themselves; at least some of the virtual agents having an access/use characteristic that allows access or use only to agents having access privilege corresponding to the agent; allowing the agents to

posses access or use privileges with respect to access or use of other agents; allowing agents to control what is revealed by those agents that they control; allowing agents to modify the agents that they control; allowing agents to replicate other agents to the extent the characteristics of the other agents are revealed; measuring actual performance of agents; inputting expected performance of agents; comparing actual performance of agents to expected performance of agents; modifying agents based on the difference between actual performance of agents and expected performance of agents; allowing communication between agents limited to what the agents reveal about themselves; determining the location of agents within the system; determining the health, status or condition of agents within the system; determining the value that other agents places on access, control, use or communication of another agent and report.

In a more specific sense, the present invention provides a system and components for the system to make it possible to optimize the design of a collaborative work space both in terms of human, pragmatic and economic values as well as pattern language values. In part, the present invention results from the present inventors' recognition that systems constructed using linear arrangements of rectangularly-based components are a source of the problem. The variety of objectives that one would ideally like to achieve in a collaborative work space cannot be achieved through the use of known components. An array of new components is required. Thus, the present invention provides a series of components and a system for using these components in combination to achieve results that have not heretofore been obtainable.

In contrast to conventional collaborative environments that do not address the entire range of basic human requirements (they require compromise and tradeoff), there is no need to compromise with the system of the present invention. The present invention provides collaborative work spaces, high density, greater individual control, larger work spaces, adjustability and reconfigurability, addresses pattern language values and provides computer-augmented design and facility management.

The present invention also provides a system for facilitating design and management of collaborative work spaces. The system is based on the recognition that a collaborative work environment is a collection of objects and that the system has rules. Thus, the system of the present invention knows the cost of certain objects, knows the architectural

rules, knows the architectural values and knows the rules of pattern language. This is achieved through the use of values stored in memory tables or the like. Moreover, the system can adjust the relative values of things such as architectural values based on a customer's or client's objectives. The system includes means, preferably electronic display monitors, for displaying environmental layout and means, such as icons, for graphically representing objects within the environment. The user can "pick up" and place the objects in desired locations within the environment. The system knows the cost of the objects selected, the architectural rules concerning its placement, the architectural values associated with particular objects in the rules of pattern language. In addition, the system can provide the total cost as well as architectural values score or in the pattern language score, on a real time basis.

In accordance with a further embodiment of the invention, the system of the present invention can be used to manage the environment. In particular, the system can be designed so that the individual system knows what objects are in the environment and where those objects are (how the environment is configured). This can be achieved in a variety of ways such as by placing chips in each of the objects or placing sensors within the environment. In this way, the system can monitor an environment once in place and send a warning, if, for example, an object is moved into a place that is architecturally unacceptable (e.g., an object is moved to place where it blocks the door). Thus, in summary, the system facilitates both design and placement of furniture in office, home and other environments and also monitors the environment once in place. This is done through a system, which can be a central computer and/or plurality of individual objects networked, so long as the system knows what the objects are and what they can do, the rules applicable to the environment and the objects and where the objects are and how they are configured. Thus, the system knows its environment, knows what objects are in its environment and what the rules applicable to that environment are.

The present invention also relates to various furniture components that make it possible to optimize human and architectural pattern language values in a collaborative work environment. In general, a collaborative work environment may be thought of as including various levels of components. In connection with the component described in this application, the components may be grouped in the following levels (from lowest to highest):

I. SUB-COMPONENTS: including, for example, secretaries, file cabinets, pigeon holes and shelves

II. PIECES: including, for example, dogs (work units), wings, tables, kiosks

III. SYSTEMS including, for example, CubeOffice™ , WorkPod™, Octopus™ (inside air moving units / lighting)

IV. WORK WALLS™ including, for example, fixed walls, rolling walls, sliding walls, folding walls, and dbl. hung walls.

V. ARMATURE including, for example, beams, trellises, chases, path edges and bases.

At the highest levels (aside from cities and regions themselves), the environment also includes buildings and the rooms within the buildings. The present invention, however, relates primarily to components below these as listed above. These components are described in the figures.

One of the principal advantages of the system of the present invention is that the components are provided (as shown in the drawings) that allow optimization of Pattern Language values. Although certain pattern language values have been used extensively in custom designs by architects such as Wright, there has to date been no way to address most of the pattern language values catalogued by Alexander in practical way with conventional off the shelf furniture, much less furniture that also addresses human values such as economic efficiency, mobility adjustability and the like. Thus, a remarkable aspect of the system of the present invention is that components allow one to address at least 100 of the 253 pattern language values catalogued by Alexander. Further information concerning these pattern language values may be gleaned from "A Pattern Language" Christopher Alexander 1977.

Another important aspect of a collaborative environment is access to information. At one level this need can be addressed by providing various printed materials throughout the work space. The furniture components of the present invention are well-suited for this purpose in that they include a variety of shelf space, work surfaces and display surfaces. The work space should, however, also include access to electronic databases including the Internet and data warehouses. To facilitate such access, the environments of the present invention preferably include display monitors throughout the space and furniture components are designed to movably support such monitors. In addition, the furniture components and armature elements are designed to conceal or guide cables and wires connected to electronic components. This collection of components and their arrangement within the environments (as shown in the drawings) are able to provide total seamless media integration within the environment. In addition, the system is highly scaleable and adaptable to new technologies that are now widely available or likely to become widely available in the next few years, including large scale electronic work walls, electronic assistants, electronic displays, real time video conferencing, intelligent agents and data warehouses. Collectively, these components provide an environment in which information can be made available as needed, i.e., "just in time information," and remote collaboration is seamless.

Thus, the system and method of the present invention provide an ideal environment for the integration of data mining technology in which information flows freely as needed in a frictionless market so that decision makers can obtain all the information they need when needed from data warehouses. Specifically, the environment includes a complete range of fully integrated media sources and displays so that, for example, a knowledge worker can turn on a computer (workstation, network computer, lap top, PDA or intelligent assistant), and ask any question from any database anywhere, in the same way that a knowledge worker today can pick up a telephone, and talk to anybody anywhere.. The present invention provides the overall process and environment to take full advantage of "just in time information" and integrate this information into the collaborative work space.

Thus, the present invention provides several functional advantages over known systems. To begin with, the present invention makes it possible to design practical layouts of components that cannot be provided using a known systems based on rectangular components. The system of the present invention is useful in facilitating the interaction

among agents, i.e., creating an environment for facilitating the interaction among agents including humans and machines. Moreover, the present invention makes it possible, for the first time to address pattern language values using standard components. In the past, known standardized systems have not been particularly useful in addressing pattern language values.

Brief Description of the Drawings

The present invention will now be described in detail with reference to the attached drawings in which:

Figure 1 is a block diagram of a single iteration of an embodiment of the present invention.

Figure 2 shows a block diagram of the process of a decision point element contained in the block diagram of a single iteration of an embodiment of the present invention.

Figure 3 is a block diagram illustrating the plurality of agents and their functions.

Figure 4 is a block diagram showing elements of the environment.

Figure 5 is a block diagram illustrating important components of the performing work element of an embodiment of the present invention.

Figure 6 presents examples or elements of the altered or output agent produced by iterations of an embodiment of the present invention.

Figure 7 contains examples or elements of the output agent and new environment interaction.

Figures 8 and 8A show a high level system flow diagram of the system of the present invention.

Figure 8B shows a sketch of a collaborative work environment according to the present invention. The environment includes tools according to the present invention as well.

Figure 9 shows a high level view of a system configuration according to the present invention.

Figure 10 is a perspective view of an adjustable height rolling kiosk component shown at a reduced height and docked with an adjustable height rolling wing work surface component.

Figures 11 and 11A are perspective view of portions of an environment according to the present invention showing rolling curved WorkWalls seating surfaces and multimedia components.

Figure 12 is another perspective view of portions of an environment according to the present invention showing reconfigurable work areas defined, part, by rolling hinged WorkWalls.

Figures 13 is perspective views of Work Pod components according to the present invention showing various possible configurations.

Figure 14 is a schematic view of a polycentric work area layout.

Figure 15 is a perspective view of cube office components including shelf cubes and base units.

Figure 16 is a top perspective view of one form of cube office system.

DETAILED DESCRIPTION

In a broad sense the present invention is the result of the synergistic combination of emerging technologies, with emerging insights as to human processes and emerging insights as to the relationship of between the two, i.e. how things that are perceived at different level of consciousness affect human processes. Thus, technologies that enable rapid reconfiguration of environments are an important component of the present invention. This applies not only to reconfigurable furniture (which the inventors have developed) but also, lighting sound and other sensory experiences that we now know affect human processes. As the ability to control the sensory inputs to agents within an environment increase, the usefulness of the present invention increases.

Another prerequisite of the present invention is an understanding of agent (e.g., human) processes that one wishes to facilitate. The present inventors have, as previously noted, developed and published various detailed models of the creative process that allows the system and method of the present invention to be used to foster group genius

In general, the system and process of the present invention address environment, process and tools in a way that creates an improved environment for group interaction. At the highest level, these areas are each addressed through description, explanation and specific physical examples. At a deeper level, the elements are addressed through high-level manuals

written in a language that can be understood by the agents. At a still deeper level, the essential concepts involved can be described in models and/or glyphs. The glyphs are original artistic expressions of concepts relating to group dynamics. Collectively, the glyphs, when used in connection with a grammar system, constitute a separate language somewhat analogous to a fourth-generation language. At a still deeper level, the present invention makes use of a series of rules or algorithms that effect an environment, process and tools.

As detailed above, the inventors have developed a modeling language and grammar system to describe some of the concepts underlying the system and method of the present invention. An embodiment of a system for facilitating collaboration among agents according to the present invention is described in figures 1-7. Figure 1 provides a block diagram overviewing a single iteration of the method of this portion of the present invention. The steps of the present invention are not intended to occur in a particular order; they may occur simultaneously or in an orderly fashion, but not necessarily in the order illustrated in Figure 1. Moreover, the specific steps shown are illustrative, not exhaustive. The process and system can include other steps.

The method shown in Figure 1 illustrates only a single iteration of an embodiment of this aspect of the present invention. An important aspect of the present invention is that the process occurs on multiple levels of recursion. Thus, it is contemplated that other iterations can, and preferably do, occur consecutively or in a chain-like manner, such as feeding the resultant agent or product of an iteration into a subsequent iteration; in addition, simultaneous multiple iterations can occur at different levels of interaction. For example, some agents within a particular iteration, such as a facilitator, may also conduct additional iterations relating to any particular step in the process or mirroring part or all of the iteration.

The system and process of the present invention are most productive when there are multiple levels of recursion and feedback occurring simultaneously. The use of an interactive process that includes multiple levels of recursion, feedback and self-adjustment yields a system and process that can be used to facilitate the interaction among agents such that synergistic results occur. In solving complex problems, for example, the system and process need not address the entire problem at once, but instead evolves toward a solution. In short, problems are dissolved, not solved.

In the single iteration shown in Figure 1, in step S1, a group or pool of agents for potential use with the system are identified. This identification step can be performed by a user of the system or by persons or systems outside the system of the present invention. These agents can include, for example, intelligent agents, persons, documents, computer software, firmware, living things, computers, and other objects. Collection by a system or person outside the system of the present invention could include, for example, a company selecting particular intelligent agents, documents, programs, and people as potential agents to be included for a particular iteration.

In step S2, an operation is conducted upon these agents. In an embodiment of the present invention, this operation includes selecting particular agents fitting a predetermined cross-section of skills or other creativity elements designed to foster operation of the present invention. The predetermined cross-section is dependent on the scope of the iteration; for example, if a particular problem is attempting to be solved for a particular group of agents, the nature of the problem and group suggests an appropriate cross-section. In addition, an embodiment of the present invention contains factors that support develop of a generic cross-section, which is alterable using iteration-specific information.

The selection process of step S2 can include, for example, querying the pool of agents for responses used in determining their amenability for the particular iteration. The querying can be intended to illicit characteristics about the agent that correspond or mesh with those characteristics identified for the predetermined cross-section. In addition, the substance of the responses themselves are useful in developing the cross-section.

In step S3, the agents selected as a result of the process of step S2 are added to an environment that has been created in step S4. Adding the agents can include connecting computers or agents via a network or other electronic or other coupling. It can also include collecting persons or groups of persons in a particular place.

Creating the environment of step S4 also includes such things as creating a particular network, designing a particular workspace, programming a computer, or other methods of collecting agents. In addition, other elements of the environment may be created. In particular, if the environment includes persons, the environment can include particular amenities designed to foster effective operation of the present invention. For example, the environment may include sectioned areas for collecting groups, wall surface writing and

drawing capabilities to allow the agents to continuously maintain information in an easily viewable area, computers for use of agents, television or other video capabilities, and toys, games, books, and other tools designed to assist agents in communicating ideas and performing other functions that comprise the function of the present invention.

In step S5, the user or agents within the system perform work. The type of work performed by the agents can include a variety of tasks or exercises designed to encourage identification and detailed definition of problems or issues specific to the iteration using methods of approaching the problems or issues that are outside the agents' usual scope of problem solving patterns. The exercises and tasks can include collecting information, role playing, game playing, research, analysis, and reporting, model building, illustration of issues using three dimensional objects and tools, and other problem-solving activities.

The results of the processes of steps S3, S4, and S5 are production of new agents, such as documents, computer programs, suggested problem approaches analogous to issues at hand, and proposed solutions. In step S6, a sophisticated decision process occurs, which is further detailed in Figure 2, described below. The outcome of the decision process produces one of two outputs to other steps. In the first output branch, the resultant new agent is fed back to the current iteration. The first step of the feedback process is to test the new agent in step S7. In step S8, a decision is made as to whether to input the new agent as a perform work function for step S5. Alternatively, the system proceeds to step S9, in which a decision is made whether to input the new agent to the environment, step S4, thereby effectively creating a new environment, or to input the new agent as another agent in the system, step S3.

In the second output branch, the output of step S6 serves as input, step S10, to a new environment. In step S11, the agent is then altered as a result of its incorporation into the new environment. In step S12, the altered agent is evaluated in a sophisticated decision process similar to step S6, as described in more detail in relation to Figure 2 below. The results of this decision process are either to feed the resultant newly altered agent back to the current iteration, via step S7, or to exit the agent from the iteration.

The exit of the agent from the current iteration can serve a variety of functions. For example, the exiting agent can provide input to another iterative process using the present invention. The exiting agent can also simply exit the process.

Two examples of the operation of an iteration of the present invention as described in Figure 1 follow. These examples are intended to be illustrative only. The examples are not intended to limit the application of the system to a particular set of agents, a particular iteration, or a particular environment. The examples are also not intended to imply that a single iteration or a particular order of steps are necessary.

The first example illustrates a facilitated creativity workshop process. In a workshop using the present invention, some number of steps of the workshop are automated, such as computerized, using the method and system of the present invention. In this example, referring to Figure 1, in step S1 a group of persons are identified as a pool of potential agents to assist in solving a particular problem; in this example, both the pool of people and the particular problem are identified by a company.

In step S2, persons in the pool are provided with information and queried by a user, such as a facilitator, who also serves as an agent, in a targeted manner designed to illicit information about their potential amenability to the problem identified and the set of skills selected by the user. A computerized matrix of skill needs matched to the problem at hand is used to select from the pool; the matrix is partially fulfilled using a selection process. In this example, this process of matching skill results, problem-specific issues, and a matrix are automated. In addition, other agents are identified, such as intelligent agents designed to obtain particular information from the Internet. These intelligent agents can be either commercially available or specifically designed and tailored to the particular problem at hand. Also as a part of step S2, either separately or as an element of the pool selection process, a set of documents and other informational items are provided to the agents.

In step S3, the persons and intelligent agents selected are collected in a common environment, which is created in step S4. The environment can include furniture conducive to creativity, moveable walls that participants can write on, toys, games, video displays, computers, and other tools for creatively producing examples and illustrating points.

Contemporaneously with steps S3 and S4, exercises or other tasks are selected for performance by the agents as step S5. These exercises can include collecting information, such as automatically searching the Internet, role playing, game playing, analysis, reporting, or other problem-solving activities. These exercises are designed to encourage the agents to function or think about problems in a way that facilitates identification and detailed definition

of the problem at hand using methods outside the scope of the usual problem solving of the agents. For example, a subgroup agents may be assigned to study and system in nature that may be suggestive of the problem at hand. The subgroup then provides their analysis and results to the selected group as a whole, which is then used for additional analysis and problem clarification. An intelligent agent may be assigned to obtain information about elements of nature when the problem is focused on a business issue.

In step S6, a decision is made as to whether the results are fed back, step S7, to the current iteration, as additional work performance, step S8, or into the environment or as additional agents, step S9. Alternatively, the results may be passed to an outside environment, step S10. In this example, the decision process is facilitated via input and evaluation using a computer program.

Following step S10, the agent is altered by the outside environment in step S11. The altered agent is then tested in step S12, in a manner similar to that of step S6, and a decision is made as to whether to exit the agent from this iteration, or to return the agent or additional information obtained as part of the altered output agent process to the current iteration through step S7.

As an example feed to an outside environment in steps S10 and S11, an initial proposal regarding the problem at hand could be sent via an agent to the management of the company. The management of the company could then provide feedback to the agent, who then returns to the environment of the current iteration to continue the iterative process.

In the second example, much more of the process is automated, such as by computer program and computerized intelligent agents. In this example, in step S1, a group of intelligent agents, each having specific functions and missions, are developed, step S2, by a user at a terminal to solve a particular problem. The functions and missions of these intelligent agents are identified or developed based on cross-indexing of preselected creativity traits and the scope of the problem at hand. In this example, an automated process assists the user with developing this cross-index.

The agents are then connected and communicate with the user via computer connection, which serves as the environment, step S4. As the user performs work, step S5, the agents provide a variety of inputs based on their assigned functions. For example, an agent could be assigned to search the Internet for associative ideas based on use of particular

keywords by the user. Thus, as the user word processes and creates keywords some agents would continuously search and display results associated with keywords or combinations of keywords.

As the user works on the problem, the results of the keyword combinations are fed back in steps S7, S8, and S9, as additional work and to other intelligent agents performing other functions; the results of these functions are also continuously provided to the user as part of the environment. In this way, a continuous feedback loop of information from the various agents, including the user, would serve as a growing set of information that is simultaneously displayed in the user's environment. At some point the user outputs the results, step S10, alters the results outside the process, step S11, and then makes a decision, step S12, as to whether the outputted result is sufficient to solve the problem for the user's needs or whether the result should return to the process, step S7, for further iteration.

The decision step S6 is a complex process that may in itself incorporate an entire iteration of the process shown in Figure 1. As shown in Figure 2, this process includes the following steps. In step S20, the original state model applicable to the iteration at hand is inputted, and in step S21 a current state model is inputted. In step S22, these two models are compared to develop a differential or delta between them. In step S23, a matrix and set of rules applicable to the issue of the iteration are developed. In step S24, the matrix and set of rules are inputted with the delta. In step S25, a first combination of the matrix and rules are applied to the delta. In step S26, subsequent combinations of the matrix and rules are iteratively applied to the delta until a provisional dissolve of the delta is reached. This process can include agents, an environment, and performance of work, as described in relation to Figure 1. In step S27, the agent produced by the combination of matrix and rules is applied to the delta to produce a provisional dissolve. In step S27, this agent is shipped either back into the current iteration, or out to a new environment, or both. A similar process occurs with regard to step S12 of Figure 1, and can occur with regard to steps S8 and S9.

Figures 3 through 7 comprise block diagrams illustrating elements supporting the various steps shown in Figure 1. In Figure 3, the plurality of agents and their functions 1 include people 2, machines 3, computers 4, software 5, firmware 6, living things 7, objects 8, input and output both among agents and external to agents 9, and an operating system 10.

In Figure 4, elements of the environment 20 include one or more agents 21, architectural components 22, objects 23, variable boundaries 24, information 25, location (micro and macro) 26, tools 27, energy 28, input and output 29 both among elements of the environment 30 and to external elements from the environment 31, and an operating system 32. Variable boundaries can include, for example, the porosity of the environment. This variable is matched to the environment based on the agents, the scope and nature of the work, and the influence of other environmental factors. Important influences on the agent or agents in relation to the environment include energy 33, the physical nature of the agents 34, the knowledge and intellectual properties of the individual agents 35, the agents' psychological makeup 36, and the knowledge base of agent characteristics 37, both for the agents as individuals 38 and as a group 39.

Figure 5 illustrates important components of the performing work element 45 of the present invention. These components include identifying or developing a goal model 46, such as an end state model that enables the problem to be created and dissolved, acquiring experience 47, reframing 48, recognizing patterns 49, building models 50, simulating 51, selecting 52, testing 53, deciding 54, and iterating 55. In addition, input and output 56 among the components and from the components to external components and an operating system 57 make up aspects of the perform work element 45 of the present invention.

Figure 6 presents examples or elements of the altered or output agent 60 produced by iterations of the present invention. The output agent 60 consists of one or more of an altered input agent 61, altered environment elements 62, new agents 63, such as work products or non-autonomous agents, and agent mission maps 64. In addition, input and output 65 among the components and from the components to external components and an operating system 66 make up aspects of the output agent element 60 of the present invention.

Figure 7 presents examples or elements of the output agent and new environment interaction 70. These elements include the output agent medium 71, such as a document or a program, mission 72, output agent feedback and communication 73, and new environment feedback and communication 74. In addition, input and output 75 among the components and from the components to external components and an operating system 76 make up aspects of the output agent and new environment interaction element 70 of the present invention.

As mentioned above, the ability to control sensory inputs to agents operating within an environment is an important enabling technology for the present invention. Thus, for example, the active control of lighting within an environment, which is by itself well known, is incorporated into the system of the present invention to achieve a synergistic improvement in human processes.

There has been recent innovations in acoustic technologies that the present inventors have found can be used to achieve similar control of sound within an environment. In particular, the present invention also contemplates extensive use of acoustic technology such as that introduced by New Transducers Ltd. Of England and described above.

In accordance with another aspect of the present invention, distributed mode speakers can be thoroughly integrated into a collaborative environment. For example, the distributed mode speakers can be built into the furniture, knowledge objects, signs, walls and ceiling tiles or even into the floor (recognizing, of course, that different materials have more of an acoustic range.

Thus, from the vantage point of the design of environments present inventors have found that there are several significant features of the distributed mode speaker design: they are inexpensive and thus can be ubiquitous within the environment; the distributed mode technology can be combined with other acoustic technologies that are known to affect environments including sound, music; white noise; sound cancellation. The emergence of technologies, such as the distributed mode speaker, that make it possible to control these acoustic effects make it possible, within the context of the present invention, to systematically control sound within an environment to, for example to facilitate an objective such as facilitating collaboration.

Thus, in accordance with the present invention, it is possible to create an "acoustic space" within any environment by, for example, building an array of speakers throughout the environment and controlling the speakers (through a mixer or the like) to broadcast music, white noise or cancellation in various combinations to create an acoustic space. This makes it possible to control the sound within the acoustic space in a systematic way to achieve a desired objective. For example it is possible to define and control the sound within several acoustic spaces defined within a collaborative environment so as to facilitate the activity occurring within each space. It is possible, for example to amplify someone's voice and play

it back so softly that in effect you really wouldn't know that you have amplified that voice, it is possible to control the amount of reverberation that the room has, it is possible to take space that doesn't have any of those characteristics and you create that reverb, it is possible to select certain frequencies that you want to cancel out while you are doing this at the same time. It is possible to create dead acoustic spaces. More importantly, it is possible to create live acoustics that have certain characteristics and if people are in a live acoustic space, they'll stop shouting over things. Because occupants will adjust how they are talking to the acoustics of their place. In short, it is possible to create actively controlled acoustic spaces within the environment – the number of discrete spaces and the precision by which they are controlled is principally dependent upon the size of the environment and the investment in hardware components. One can create a different kind of acoustic space, not only as a fixed space but variable. A computer and other equipment can be used to monitor the acoustic space and allow active control by a computer programmed to establish different kinds of spaces and do space characteristics and shape the acoustic space, as you want.

Of course, there are existing technologies for actively controlling lighting and emerging technologies for control of smell and taste. All of these technologies are preferably employed to the extent practical.

In this way the environment is controlled in relationship to the creative process. This is possible to the extent that those things that stimulate the senses (and thus affect the environment) such as sound, light, smell can be actively controlled in relationship to the process.

Thus, the present invention provides an environment in which the configuration of furniture, lighting, and sound can all be actively controlled in relationship to the process being conducted within the environment. To use this environment to facilitate collaboration of agents within an environment one must have a model of the process being conducted within the environment. In the case of problem solving, for example, the present inventors have developed a model of the creative process that allows one understand how an environment should be controlled at various stages of the creative process.

The environment can be tailored to a process occurring within the environment provided the process is mapped. The present inventors have, as discussed above, developed a map of the creative process referred to as the solution box. The solution box is a 7x7x7 three

dimensional grid mapping Design against Formation against Vantage Point that define where a group is within the creative process. Based on one's location within the solution box a specific kind of environment that will facilitate the process is defined. The system of the present invention makes it possible, therefore, to facilitate a process in real time by modeling the process as a multi-step process, defining environmental characteristics that facilitate various steps in the process determining in real time where one or more agents are within the process, and controlling the configuration, lighting, sound or other sensory aspects of the environment based on the agents location within the process.

At its highest level, the currently preferred embodiment of the system for optimizing human and architectural pattern language values of the present invention is based on the recognition that a collaborative work environment is a collection of objects and that the system has rules. Thus, the system comprises a computer system that has means for storing information concerning: what objects can be used within an environment, the cost of each of the objects, the architectural rules governing the objects and the environment, the architectural values associated with the objects and the environment and knows the rules of pattern language. This data can be stored in memory tables or any other suitable means.

Since some of the values, such as architectural values, vary according to a customer's taste or preferences, the system preferably includes means for adjusting the relative values of things such as architectural values based on a customer's or client's objectives.

The system also includes means, preferably electronic display monitors, for displaying a representation of the environmental layout and means, such as icons, for graphically representing objects within the environment. In the preferred embodiment, the user can use a pointing tool, such as a mouse, to "pick up" and place the objects in desired locations within the environment. Since the system knows the cost of the objects selected, the architectural rules concerning its placement, the architectural values associated with particular objects in the rules of pattern language, the system can provide the total cost as well as architectural values score or in the pattern language score, on a real time basis.

In accordance with a further embodiment of the invention, the system of the present invention can be used to manage the environment. In particular, the system can be designed so that the individual system knows what objects are in the environment and where those

objects are (how the environment is configured). This can be achieved in a variety of ways such as by placing chips in each of the objects or placing sensors within the environment. In this way, the system can monitor an environment once in place and send a warning, if, for example, an object is moved into a place that is architecturally unacceptable (e.g., an object is moved to place where it blocks the door). Thus, in summary, the system facilitates both design and placement of furniture in office, home and other environments and also monitors the environment once in place.

While there are various ways of operating and configuring the system of the present invention, Figures 8 and 8A show a high level system flow diagram and Figure 9 shows a high level view of one possible system configuration according to the present invention.

As shown in Figure 9, the system is adapted for use by a User 1 working at a personal computer or work station 22 that includes a display monitor, which serves as the display means. Personal computer 22 may also include a CPU for performing all system functions or, as shown, the computer may be linked, as indicated at 24 and 26, to a network 5 that includes a mainframe or server computer 27. Although a specific hardware configuration is shown, the hardware configuration is not critical to the system of the invention. Specifically, as noted before, all the system functions could be performed on a stand-alone computer. The system stores (preferable in RAM) data concerning various objects (indicated as objects 1, 2 . . . n) that are available for use within the environment. For each object, the system should store at least data concerning the object's size, shape and location within the environment. The system also stores in memory data relating to the parameters of the environment and applicable architectural rules. Again, the location of this memory within the system and environment is not critical. For example, much of the information concerning the attributes of the objects could be stored within or on the objects themselves if each object includes a microchip or even a CPU. There are, of course, various ways of identifying the location of an object within the system, including, without limitation, sensors, radio signals hardwiring and infrared signals and the like. the objects should preferably be "networked" in a broad sense so that they can communicate with or be sensed by other parts of the system. Moreover, if the object is capable of reconfiguration, the system preferably includes some means (either internal or external to the object itself) for recognizing the current configuration of each object.

The system also includes various tables containing information concerning the objects selected. Specifically, the system preferably includes at least three tables: a table concerning the cost of each available object; a table concerning the architectural value associated with each available object; and a table concerning the pattern language value associated with each available object.

The system shown in Figure 9 operates as shown in Figures 8 and 8A. Specifically, the system initially prompts, preferably through the display monitor, the customer to input his or her name at Step MS1. At Step MS2, the customer is asked to select an objective. This objective may be selected from a menu that includes choices such as "MAXIMUM ECONOMIC EFFICIENCY" or "MAXIMUM PATTERN LANGUAGE VALUE" or more detailed choices such as "MAXIMIZE NATURAL LIGHT" or "MAXIMIZE DENSITY." Alternatively, this list could include, as a subroutine, a customer questionnaire from which data could be obtained concerning customer preferences.

Regardless of how the customer preferences are ascertained, the system preferably includes a means such as one of the computers 2, 7 for adjusting architectural and pattern language values stored in the tables as shown at Step MS3. More specifically, the values contained in Tables 2 and 3 which identify an architectural value and a pattern language value associated with each object are updated to reflect the customer's preference. Thus, for example, if a customer has indicated that there is a premium for economic efficiency, then those architectural values that provide, for example, greater density are given a higher value. Alternatively, if the customer has indicated a preference for maximum natural light, those objects that enhance natural light will receive greater value.

At Step MS4, the customer is asked to select or input environment parameters. This could be done in several different ways. The customer could be presented with several standard environmental configurations ("boxes") and asked to select among these if the design is being done for a building with the standard box-type layout. More likely, however, the customer is asked to provide an outline of the environment parameters of the environment for which the design is intended. This would include an outline of the exterior walls, including an indication of doors, windows and utilities.

Based on the input at Step MS4, the system, at Step MS5, displays the environment as specified by the customer. In addition, at Step MS6, the system displays

representations, preferably icons, of available objects for location within the environment. Preferably, the available objects are displayed in proportion to their size or, if this is not practical, are displayed to scale once selected.

The system also, at Step MS7, displays the cost, architectural values and pattern language values of the system as designed thus far. At this initial step, these values will, of course, naturally, be 0.

Each time an object is placed within the environment, a determination is made, at Step MS9, whether the location selected within the environment satisfies the set of architectural rules (stored within the system) that are specified for the particular jurisdiction. If not, the system outputs an error message (at Step MS10) explaining the problem and prompting the user to select another option. If, on the other hand, the location satisfies all applicable architectural rules, then the cost, architectural and pattern language score is updated at Step MS11, the display of the environment is updated at Step MS12 and the display of available objects is updated at Step MS13.

The user is then prompted, at Step MS14 to confirm the selection. If the user chooses not to confirm the selection, then the object is deleted from the display of the environment at Step MS15 and the tables and display are updated (reset) at Step MS16.

If, at Step MS14, the user confirms the selection and placement of the object, then an inquiry is made, at Step MS17, as to whether the design is complete. If not, the user is returned to Step MS8 and the process is repeated until the design is complete. Once the design is complete, the user is given an opportunity, at Step MS18, to print out or to otherwise record the final design in the system, and the process is complete.

As mentioned previously, the present invention also relates to various furniture components that make it possible to optimize human and architectural pattern language values in a collaborative work environment. In general, a collaborative work environment may be thought of as including various levels of components. At the highest levels (aside from cities and regions themselves), the environment includes buildings and the rooms within the buildings. The present invention, relates primarily to components below these levels which may be characterized as follows: armature level components; divider (WorkWall™) level components; work station system level components; sub-components; and, at the lowest level, pieces. The present invention provides components specifically

assigned to optimize human and architectural pattern language value at each of these levels. These components are described in the figures attached hereto and in the appendices hereto.

Figure 8B shows a sketch of a collaborative work environment according to the present invention. The critical aspect of this collaborative environment is the overall integration of media into the work environment. Thus, the environment of the present invention can include a range of multi-media devices, including whiteboards that are marked using markers, pixelated writing boards for enhanced 3D-type graphics, electronic whiteboards that allow electronic input and output, whiteboards that include full color scanning and copying capabilities and interactive whiteboards. As used herein, the term "whiteboards" is intended to encompass the full range of work walls or writing walls, and is not intended to be limited to such walls that are the color white. Indeed, the standard writing walls of the present invention are preferably gray in color.

With specific reference to Figure 8B, the environment shown is reconfigurable to facilitate the interaction of agents (humans 2, machines 3, 4, groups 5, organizations and combinations thereof), within the environment in accordance with a predetermined model of the interaction of the agents (in this case a model of the creative process and group interaction as described above) that prescribes appropriate environment conditions based on the status of agent interaction within the system of the interaction of the agents. The environment shown a large-scale whitewall or WorkWall 13 that could be either a marker-type whitewall, or an electronic whitewall. The environment also includes a large-scale video screen 20 to allow remote collaboration. Additionally, knowledge workers 2, 5 are shown working with a variety of components including laptop computers 30, personal digital assistants 40 and a collaborative multi-screen work station 50 that can serve as one means for controlling various physical attributes of the environment. This sketch shows a the total integration of media into the environment and the use of the furniture systems of the present invention within the environment. The workwall 10 includes a series of Hypertiles™ and discloses the possibility of an intelligent assistant. The environment further includes means, such as sensors 7 or human observers 2, for determining the location of physical components within the environment. The environment also includes means, such as humans or machines moving reconfigurable components, for reconfiguring physical components within the environment -- the WorkWalls and other components can be supported on casters.

The environment also includes means, such as sensors 7 or human observers 2, for determining the lighting characteristics in a plurality of discrete regions within the environment. The environment also includes means, such as humans and/or computers moving reconfigurable components or operating adjustable components, for adjusting lighting 18 within the environment. The environment also includes means, such as sensors 7 or human observers 2, for monitoring sound within the environment. The environment also includes means, such as humans and/or computers moving reconfigurable components or operating adjustable components such as distributed mode panel speakers 8) for adjusting sound within the environment. The environment also includes means (such as sensors 7 or human observers 2) for monitoring and determining the status of agent interaction 5 within the environment; and means (humans or computers controlling components) for reconfiguring physical components and adjusting lighting and sound within the environment in response to the determination of the status of agent interaction within the environment.

As detailed below, the environment can include a variety of reconfigurable components including, without limitation, rolling work walls, workpods on rolling casters, rolling kiosk components, stackable shelf cubes, rolling wing work surface components.

The fully integrated environment of the present invention, an example of which is shown in Figure 8B, allows rapid reconfiguration and prototyping in a collaborative way. The environment also allows for the facilitation of interaction among intelligent agents to achieve rapid design and rapid prototyping. Preferably, the environment can include multiple generations of development in a single space.

The use of media, which is most completely illustrated in Figure 8B, is an important aspect of the present invention. In this regard, it should be understood that the environments of the present invention are scaleable and adaptable to new generations of media. The environments allow full integration of a variety of media and are responsive to the needs of all of the senses.

To provide further understanding of how these components make it possible to optimize both human and architectural pattern language values various components, sub-components and pieces will now be illustrated and described with reference to Figures 10-16.

Figure 10 shows a kiosk component and a wing component docked together. The ability of component to dock with one another is an important aspect of the present invention in that it provides efficient utilization and easy user configurability.

The kiosk component 110 includes multiple work surfaces 112 including a work surface on which a keyboard may be. The work surface can be moved into one of three different slots to allow work surface height adjustments. Moreover, the slots can receive work services with a different configuration. The top of the base supports a computer monitor 114. The entire structure supported on rolling casters (wheels) 116 so that the user without technical assistance can easily move the kiosk. Computer cables are managed through a built-in cord channel. The lower cabinet space is designed to accommodate computer central processing units or supplies and is accessible in the front. The entire unit can be easily maneuvered and relocated on its smooth-rolling casters.

In this view, the kiosk is combined with a MEDIUM WING™ component 120 to build a cohesive, portable workstation. The wing component 120 is a flexible work surface designed to adapt to a variety of needs. The wing component is extremely portable and can be easily maneuvered on its smooth-rolling casters 126 to fit in almost any work area. The height of the work surface 122 is adjustable to accommodate a user that is either sitting or standing. The curved work surface design surrounds the user with an efficient work surface and the built-in tilted footrest makes the wing as comfortable as it is versatile.

Figures 11, 11A and 12 show a portion of an environment that includes work walls 130, 131 an enclosed space, worktable, and chairs. Among other things, this portion of the environment includes WORK WALLS™ supported on wheels 136 to provide mobility, flexibility and efficient storage. WORK WALL™, are an entire work space on wheels and include an off-white writing surface made of porcelain steel that provides opportunity for drawing directly on the surface and also allows easy attachment magnetic display tiles 134 to the surface. According to another aspect of the present invention, either the surface itself or the tiles attached thereto can be provides with a sticky surface such as a POST-IT (® 3M Corp.) surface. In accordance with one aspect of the present invention, the display panel surfaces are provided with a roughened texture to allow users to write on the wall with a variety of graphical tools (conventional "white boards" can only be written on with markers). Alternatively, a portion of the panel surface may be pixelated (roughened) to provide a

region that can be written on with other graphical tools (chalk, crayons, pencils etc.). The inventors have found that this allows much greater graphical expression. Finally, at least some of the WORK WALLS™ or other display panels should be tall (more than six feet high) so that they can be used as room dividers to partition an environment in different rooms.

Figures 11-11A show portions of an environment according to the present invention including large scale rolling work walls130, radiant room and armature components 138. The armature components 138 , which appear as beams along the ceiling of the environment, provide a sense of place and also function to conceal cables and other utility connections. The portion of the environments shown in these figures demonstrate the ability to achieve architectural scale and pattern language values using the components within the environment, the possibility of providing of multimedia integration, and particularly in Figure 11A, the use of architectural armature including a hollow beam that serves both a functional purpose (covering cables) and a pattern language purpose in addition to providing a sense of place (architectural armature).

Figures 11 and 11A also show a plurality of bookshelves 139 grouped together with WORK WALL™ display panels 130 acting as a room divider. Display monitors are included as a part of the environment in accordance with the present invention.

Figure 12 is a perspective view of a Rapid Deployment System (RDS) version of the system of the present invention in use. The components used in the Rapid Deployment System are essentially the same as those used and described elsewhere, but these components can be moved into a generic environment such as a hotel conference facility and set up quickly to establish a suitable, although not necessarily ideal, environment for facilitating group collaboration. The this environment includes both WORK WALL™ display panels 131 that are flat and hinged and curved WORK WALL™ display panels 130. An important feature of the components used in the RDS is the extreme mobility and ruggedness of these components.

Figures 13-13F show a WorkPod™ work unit component 170 of the present invention. As shown in these views, the WORK POD includes a plurality of modular section units 172. Each unit is suspended from its own external mast or support 174. The mast or supports are supported on smooth rolling casters 176 and designed to allow a variety of

components to be snapped on, such as overhead storage and shelf units 173, workstations 175, tool caddies and tables that rotate out into the center of the pod for use by small teams.

A unique articulating translucent vane 179 attaches to the top of the mast. The vane incorporates the pods lighting system 181 and also allows the pods residents to make adjustments to direct light and also adjust ventilation.

Each section of the pod may be deployed independently or in combination with one or more other sections to form a variety of configurations as illustrated in Figures 13-13F.. A common set-up is the circular one shown in Figure 13F, but other set-ups are possible and may be employed by several pod residents to help the facilitate their current work process. Thus, the pod may be moved and reconfigured by the resident without any technical assistance.

Figures 13D-F show alternative pod constructions and configurations according to the present invention. As shown in Figures 13D and 13E in particular, the pod units can be hinged to roll in to different configuration other than the circular configuration previously described. Figure 13E shows an arrangement in which the pod sections are arranged in an S-curve. Figures 13-13F also show other aspects of the pod design including the use of subcomponents such as secretaries, file cabinets, pigeon holes and shelves. Each of these subcomponents can be supported (directly or indirectly) on the mast and is supported on rolling casters. The adjustability of the translucent vane is also evident in these drawings. Preferably, the light source is directed toward these vanes so that it is reflected down by the vane onto the user to allow variable lighting. The light source itself may be used as a handle for adjusting the location of the translucent vane as shown, for example, in Figures 13A and 13F.

From all these drawings, it is readily apparent that the pod design offers a tremendous level of adjustability and possible configurations.

Figures 13A, 13B and 13C show a single unit or section from which the work pod can be constructed. As shown therein, the entire system is hung from a mast 179 that is supporting rolling casters 176. The system shown includes an adjustable work surface 171 that may be pulled out from a rolling computer support, work surfaces at a variety of heights, and shelves as well as adjustable lighting. Figure 13C shows a perspective view of a work section in which one of work surface system pulled out and used as a small conference table.

The WorkPod returns to active duty an old architectural Pattern Language value of A-Room-Within-A-Room. This pattern language value was used extensively in custom designs by Wright and is recognized by Alexander. To date, however, there has been no practical way to do it with furniture. Let alone, furniture that moves. The Work Pod also provides knowledge workers significantly larger work areas and several of them. The Pod can function as a conference room for four (swing out desks configure to a table), a work are for a Team of three and a home for a single individual. A landscape of WorkPods, distributed in an appropriate pattern and augmented with the components of the present invention can accomplish the same density of typical solutions while providing greater individual spaces and a larger number of functional-type areas - Radiant Rooms as example. The system of the present invention uses available space and makes circulation paths serve many purposes. These layouts cannot be achieved with conventional furniture approaches. Even the better known mobile pieces have failed to grasp the importance of the larger armature-level pieces and thus can not replicate the effect of the present invention.

Fig. 14 shows one version of a polycentric work area layout that is possible in accordance with the present invention. In this instance, the work area layout follows a city metaphor with the principal flow of people through the layout indicated as "Main Street." As shown, this layout features maximum natural light to all work areas, omni-directional access to work areas; promotes interaction at the team, unit and company levels and allows individual and team control of access and privacy. The layout also utilizes circulation areas for storage, group tools, display and visual variety, reinforces individual team and unit identity. In addition, the layout reinforces certain building features, including an atrium, the outer wall articulation, column spacing, all which can be accomplished with one semi-custom, locally built system.

The principal features of this environment are maximum natural light to all work areas, omni-directional access to work areas to promote interaction. Circulation area are used for storage, group tools, display and visual variety. The environment includes clusters of WorkPods 170 of the type described above.

This layout also allows maximum future flexibility for new layouts. It is important to note, however, that Fig. 14 is just one example of a layout that can be accomplished using a

flexible system of components of the type described herein. An important aspect of the present invention is, indeed, the flexibility that is available.

Figure 15 shows shelf cubes 190 that may be used to provide cube office components. The shelf cube 190 provides adjustability without technical assistance and can be used to divide an office space. Each cube is a modular, versatile and efficient approach to shelving needs. The cubes preferably include dimple-like indentations on the top and rounded nubs on the bottom of each unit so that the shelf cubes are stackable and extremely stable. Each unit can stand alone or can or be combined with others stacking up to four cubes tall in four directions. The system also can include a plurality of base units 194 as shown to provide stability of the cube office system 190. The system of the present invention preferably includes units of different width such as, for example, six inch, twelve-inch and eighteen inch wide units. The user can assemble cube system with minimal number of tools.

Figure 16 shows a perspective view of a cube office system 190 according to the present invention. The partial top view shows two-layers of cubes 192 arranged with a space 191 in between. The space between the cubes, typically about 3 inches, can be used for acoustics (by providing reflective or absorbing surfaces), for utilities (by allowing a post and beam wire guide arrangement) and to allow for adjustable dividers, such as shoji screens, to be concealed. In this way, the cube office system can be used to provide great flexibility in dividing an environment to work spaces and to give users adjustability (through the use of shoji screens) as to degrees of privacy and the like. Thus, the preferred form of cube office system 190 includes cubes 192 stacked back-to-back with a gap in between to allow a shoji screen and utility beam to be located between the stacked cubes.

In addition to the components illustrated, other components contribute to reconfigurablity of an environment. Reconfigurability is, of course, important to address human values such as economic efficiency and flexibility. For example, rolling bookcases of various heights provide mobility and variation in scale of furniture that makes partitioning of space possible. Different ranges of partitioning of any work space can be achieved through the use of components of various heights. Moving storage capabilities can be provided.

A work unit that contains two compartments for letter-hanging files and eight drawers for storage as well as double-sided write-on, write-off WORK WALL™ may also be provided. Again, the surface of the WORK WALL™ is preferably magnetic to hold

magnetic tiles or other pieces. The work unit includes smooth-riding casters to allow mobility without technical assistance. Thus, this single unit provides a file for storing information, drawers, work walls, and the ability to provide a work space as desired all in a component that is mobile.

As noted above, one of the principal advantages of the system of the present invention is that the components provided allow optimization of Pattern Language values. Although certain pattern language values have been used extensively in custom designs by architects such as Wright, there has to date been no way to address most of the pattern language values catalogued by Alexander in practical way with conventional off the shelf furniture, much less furniture that also addresses human values such as economic efficiency, mobility adjustability and the like. Thus, a remarkable aspect of the system of the present invention is that components allow one to address at least 100 of the 253 pattern language values catalogued by Alexander. Further information concerning these pattern language values may be gleaned from "A Pattern Language" Christopher Alexander 1977. Specifically, and without limitation, the following values, listed with the number assigned by Alexander, may be addressed using the system of the present invention:

1. INDEPENDENT REGIONS
2. DISTRIBUTION OF TOWNS
5. LACE OF COUNTRY STREETS
8. MOSAIC OF SUB CULTURES
9. SCATTERED WORK
14. IDENTIFIABLE NEIGHBORHOOD
15. NEIGHBORHOOD BOUNDARY
19. WEB OF SHOPPING
24. SACRED SITES
26. LIFE CYCLE
28. ECCENTRIC NUCLEUS
29. DENSITY RINGS
30. ACTIVITY NODES
31. PROMENADE

36. DEGREES OF PUBLICNESS
37. HOUSE CLUSTER
41. WORK COMMUNITY
45. NECKLACE OF COMMUNITY PROJECTS
57. CHILDREN IN THE CITY (Furniture scaled for children & tools, i.e., WorkWalls, etc.
59. QUIET BACKS (through layouts using city metaphor made possible by:
    - Armature Elements
    - Systems Pieces: WorkWalls, Pods, Cube Office making a landscape (foreground, middle, background)
    - Variety of shapes, textures, colors and degrees of view - solid, translucent, transparent, open
60. ACCESSIBLE GREEN
67. COMMON LAND
68. CONNECTED PLAY
    --Armature & Systems Components - Landscape
69. PUBLIC OUTDOOR ROOM
79. YOUR OWN HOME - Work pods, cube offices, work furniture clusters, work walls
80. SELF-GOVERNING WORK SHOPS & OFFICES
82. OFFICE CONNECTIONS
83. MASTER AND APPRENTICES
88. STREET CAFE
93. FOOD STANDS
94. SLEEPING IN PUBLIC
102. FAMILY OF ENTRANCES
107. WINGS OF LIGHT
110. MAIN ENTRANCE
111. HALF HIDDEN GARDEN
112. ENTRANCE TRANSITION
114. HIERARCHY OF OPEN SPACE
115. COURTYARDS THAT LIVE

--Armature, systems layout, etc.

117. SHELTERING ROOF - Trellises

119. ARCADES - Armature

120. PATHS & GOALS - Wire Chase System, Elements In Background

121. PATH SHAPE - Wire Chase System On Floor

124. ACTIVITY POCKETS - Layout Clusters, WorkWalls, Radiant Rooms

127. INTIMACY GRADIENT - Cube Offices, Pods - Variety

128. INDOOR SUNLIGHT - Articulatum to outside Windows in Skylights - advantage building assets

129. COMMON AREA AT THE HEART

130. ENTRANCE ROOM

131. THE FLOW THROUGH ROOMS

132. SHORT PASSAGES

133. STAIRCASE AS A STAGE

134. ZEN VIEW

135. TAPESTRY OF LIGHT & DARK

146. FLEXIBLE OFFICE SPACE

--Flexibility of Layout

147. COMMUNAL EATING

148. SMALL WORK GROUPS - Flexibility - Reconfiguration (teams come & go)

149. RECEPTION WELCOMES YOU

150. A PLACE TO WAIT

151. SMALL MEETING ROOMS

152. HALF-PRIVATE OFFICE - Cube Office Octopus pods can do this

--Armature with furniture. flexibility

153. ROOMS TO RENT - Office Hoteling - adjustability allows it

156. SETTLED WORK

157. HOME WORKSHOP - Take It Home scale/style allows it

159. LIGHT ON TWO SIDES OF EVERY ROOM - Flexibility of layout translucent effect of Cube Office & Pods (room within a room)

161. SUNNY PLACE - Take advantage of it

164. STREET WINDOWS - Take advantage of it

165. OPENING TO THE STREET - Take advantage of it

176. GARDEN SEAT

179. ALCOVES - Armature, Pods, Cube Office, Work Walls

180. WINDOW PLACE

185. SITTING CIRCLE

190. CEILING HEIGHT VARIETY - Armature, Trellises, Pod Peddles

191. THE SHAPE OF INDOOR PLACE

192. WINDOWS OVERLOOKING LIFE - "Windows" in Cube Office Pods

193. HALF OPEN WALL - Cube Office Work Pods

194. INTERIOR WINDOWS - "Windows" in Cube Office Pods

196. CORNER DOORS

197. THICK WALLS

198. CLOSETS BETWEEN ROOMS

200. OPEN SHELVES

201. WAIST HIGH SHELF PLUS POD
--Cube Office System

202. BUILT IN SEATS - Armature systems (Platforms)

204. SECRET PLACE - Flexible layout allows this

205. STRUCTURE FOLLOWS SOCIAL SPACES - on our scale: the work dictates the shape not the system

225. FRAMES AS THICKENED EDGES - WorkWall trim & other elements

235. SOFT INSIDE WALLS - Fabric on pods, screens, etc.

236. WINDOWS WHICH OPEN WIDE

237. SOLID DOORS WITH GLASS - Cube Office

239. SMALL PANES - Cube Office

241. SEAT SPOTS

243. SITTING WALL

244. CANVAS ROOFS - Cube Office Trellises

249. ORNAMENT - with subcomponents - with system complexity - ornamental effect

250. WARM COLORS

252. POOLS OF LIGHT

253. THINGS FROM YOUR LIFE - the system provides space to do this.

Another important feature of the collaborative environments of the present invention are their ability to provide access to information through a totally integrated multimedia approach ranging from providing various printed materials and graphics throughout the work space to the use of "just in time" information systems. The furniture components of the present invention are well suited for this purpose in that they include a variety of shelf space, work surfaces and display surfaces. The workspace also preferably includes access to electronic databases including the Internet and data warehouses. To facilitate such access, the environments of the present invention include display monitors throughout the space and furniture components are designed to movably support such monitors. In addition, the furniture components and armature elements are designed to conceal or guide cables and wires connected to electronic components. This collection of components and their arrangement within the environments as shown in the drawings are able to provide total seamless media integration within the environment. In addition, the system is highly scaleable and adaptable to new technologies that are now widely available or likely to become widely available in the next few years, including large scale electronic work walls, electronic assistants, electronic displays, real time video conferencing, intelligent agents and data warehouses. Collectively, these components provide an environment in which information can be made available, as needed, i.e., "just in time information," and remote collaboration is seamless.

Moreover, the system and method of the present invention provide an environment that is uniquely complementary to systems, such as "query tone" technology, for providing "just in time information." Specifically, as illustrated in Figure 8B and elsewhere, the environment includes a complete range of fully integrated media sources and displays so that, for example, a knowledge worker can turn on a computer (workstation, network computer, lap top, PDA or intelligent assistant), and ask any question from any database anywhere, in the same way that a knowledge worker today can pick up a telephone, and talk to anybody anywhere.

As noted previously, the present invention particularly relates to a system and method for optimizing a collaborative work space that is used in connection with the inventor's system and method for facilitating communication and other interaction among agents (humans, machines, groups, organizations and combinations thereof) so as to provide feedback, learning and self-adjustment among the individual agents thereby creating an environment for interaction (consisting of environment, tools and processes) that facilitates emergent group genius in a radically compressed time period.

Embodiments of the present invention have now been described in fulfillment of the objectives of the present inventions. It will be appreciated that these examples are merely illustrative of the invention. Many variations and modifications will be apparent to those skilled in the art.